CLAIMS

What is claimed is:

1. A process for forming a nanosize ceramic powder comprising:

forming a precursor ceramic material comprising a fugitive constituent and a non-soluble constituent in a single phase;

contacting the precursor material a selective solvent to form a solution of the fugitive constituent and a residue of the non-soluble constituent,

the precursor sufficiently reactive with the solvent to form the solution of the fugitive constituent in the solvent and form the nondissolved residue of the non-soluble constituent

the precursor material and the non-soluble residue sufficiently insoluble in the solvent such that there is insufficient precursor material and non-soluble residue in solution to deposit and precipitate upon the residue of the non-soluble-constituent,

the fugitive constituent being sufficiently soluble in the solvent such that the precursor reacts with the solvent to form a solution of the fugitive constituent without precipitation and deposition of fugitive constituent upon the residue of the non-soluble constituent in the form of nanosize particles;

removing the selective solvent solution from the residue to form a nanosize powder of the non-soluble constituent.

2. The process as in Claim 1 wherein the precursor is $BaCe_{(1-X)}RE_XO_{3-\delta}$ or $SrCe_{1-X}RE_XO_{3-\delta}$ and the composition of the nanosize powder is $Ce_{1-X}RE_XO_{2-\delta}$ where RE is a rare earth metal or Y, x is between 0 and about 0.25, and δ is between 0 and about 0.13.

3. The process as in Claim 1 wherein the precursor is $BaZr_{1-X}RE_XO_{3-\delta}$ or $BaZr_{1-X}REXO_{3-\delta}$ and the composition of the nanosize powder is $Zr_{1-x}RE_XO_{2-\delta}$ where RE is a rare earth metal or Y, x is between 0 and about 0.25, and δ is between 0 and about 0.13.

4. The process as in Claim 1 wherein the composition of the resultant nanosize powder is Al_2O_3.

5. The process as in Claim 3 wherein the precursor is selected from the group consisting of $BaAl_2O_4$, $Ba_3Al_2O_6$, and $NaALO_2$.

6. The process as in Claim 1 wherein the composition of the resultant nanosize powder is Cr_2O_3.

7. The process as in Claim 6 wherein the precursor is $MgCr_2O_4$.

8. The process as in Claim 1 wherein the composition of the resultant nanosize powder is ZrO_2.

9. The process as in Claim 8 wherein the precursor is $BaZrO_3$.

10. The process as in Claim 1 wherein the composition of the resultant nanosize powder is TiO_2.

11. The process as in Claim 10 wherein the precursor is $MgTiO_3$, or Mg_2TiO_4.

12. The process as in Claim 1 wherein the composition of the non-soluble constituent and the nanosize powder is V_2O_5.

13. The process as in Claim 12 wherein the precursor is $Na_4V_2O_7$

14. The process as in Claim 1 wherein the selective solvent is water.

15. The process as in Claim 1 wherein the selective solvent is an acid.

16. The process as in Claim 15 wherein the acid is selected from the group consisting of HNO_3, HCl, H_2CO_3, and H_2SO_4.

17. The process as in Claim 15 wherein the acid is contacted with the precursor with an acid gas.

18. The process as in Claim 17 wherein the acid gas is SO_3, N_2O_5, CO_2 or HCl.

19. The process as in Claim 1 wherein the selective solvent is a reacting gas dissolved in a non-aqueous polar solvent.

20. The process as in Claim 19 wherein the polar solvent is selected from the group consisting of formamide, N-Methyl-acetamide, N-Methyl-formamide, N-Methyl-propionamide, propylene carbonate, and ethylene carbonate, and the reacting gas is selected from the group consisting of CO_2, SO_3, SO_2, and N_2O_5.

21. A process for forming a nanosize metallic powder comprising:

forming a precursor metallic material comprising a fugitive metal constituent and a non-soluble metal constituent in a single phase;

contacting the precursor material a selective solvent to form a solution of the fugitive constituent and a non-dissolved residue of the non-soluble constituent,
the precursor sufficiently reactive with the solvent to form the solution of the fugitive constituent in the solvent and form the non-dissolved residue of the non-soluble constituent
the precursor material and the non-soluble residue sufficiently insoluble in the solvent such that there is insufficient precursor material and non-soluble residue in solution to deposit and precipitate upon the residue of the non-soluble-constituent,
the fugitive constituent being sufficiently soluble in the solvent such that the precursor reacts with the solvent to form a solution of the fugitive constituent without precipitation and deposition of fugitive constituent upon the residue of the non-soluble constituent in the form of nanosize particles;

removing the selective solvent solution from the residue to form a nanosize powder of the non-soluble constituent.

22. The process as in Claim 21 wherein the precursor is an alloy or an intermetallic compound.

23. The process as in Claim 21 wherein the precursor is PaPd.

should be BaPd
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24. The process as in Claim 21 wherein the selective solvent is an acid.

25. The process as in Claim 21 wherein the selective solvent is HCl.